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ABSTRACT

English for special purposes (ESP) is the fastest growing facet of language teaching, led by the efforts of British and American linguists. The learner-centered orientation in English-as-a-second-language instruction and the expressed need of people around the world have stimulated development in the field. ESP courses are generally either occupational or educational in emphasis, and are either offered independently or integrated with content areas. Four elements are recognized as essential to ESP courses: needs assessment, materials development, teacher preparation, and evaluation. ESP research, particularly concerning the language of science and technology, has developed four basic emphases: traditional attitudes to the language of science, linguistic analysis of the lexicon, linguistic analysis of syntax, and discourse analysis. While no single model exists for the development of instructional materials because of the diversity of needs and program objectives, general elementary programs teaching English in a science context have been created and some other materials have found widespread use. There have been a variety of approaches to ESP course design, but the elements that need development are a finite structural approach for program sequencing and a strong theoretically-based curriculum design model for materials development oriented to client needs. Thirty-three references are included. (MSE)

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THE THEORY AND PRACTICE OF TEACHING ENGLISH FOR SPECIAL PURPOSES

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0. ESP DEFINED

There is probably no facet of language teaching around the world today that is growing faster than English for Special Purposes (ESP). There has been a pronounced shift away from Standard English as a Foreign Language (EFL) type courses to ESP-based syllabuses, primarily in overseas programs, during the last seven or eight years. As evidence of this numerous texts are now regularly appearing on the world-wide book market that deal with a large number of different professional areas that English language teaching is now involved with. It is well within the realm of possibility that in the near future the vast majority of overseas English programs will be involved with some type of ESP. True, there will always be foreign colleges and universities that will want to teach English as a Foreign Language, much like French, German, Arabic, etc., are taught in this country, i.e., as part of a general humanities curriculum, however because of the tremendous proliferation of science and technology in English during the post-World War II years the need for ESP programs will be paramount in this field.

The science and technology that has become widespread during the last thirty years is largely a product of American scientific effort and genius. For the most part the spread of this technology has taken place through the medium of English, because it has been either by the American government or through a multitude of American corporations that it has been disseminated throughout the free world. Yet even though this is the case, ESP teaching has for the most part been a province of the British teaching community, with little input until this decade by American English teaching specialists. Among the many reasons for this anomaly are: (1) that many Third World nations do not want American involvement in their educational systems because of a fear (whether unfounded or not) of U.S. cultural imperialism; (2) that the American EFL/ESL community is a rather young entity within our educational establishment, in fact the national Teachers of English to Speakers of Other Languages organization is only twelve years old. (3) In England there has been a longer tradition of viewing language as it is used situationally because of the prevalence of Firth's Context of Situation model being one of the guiding theories of British general linguistics. It has only been during the last eight or ten years that American scholars and practitioners have been able to both theoretically and practically get into ESP work because of the rise of the learner-centered cognitive code theory, and also because of the increasing theoretical importance of the influence of sociolinguistics upon L2 teaching. (4) Finally, the British, through the many English teaching branches of the British Council, were in a better position to take advantage of local overseas ESP needs as they arose because they were "on the spot" long before the American bi-national centers were, and unlike our bi-national centers, the British Council's branches in the Third World have shown little reluctance to become involved in ESP work.

The situation just described is generally the case today, but it is very pleasing to note that changes are taking place. TESOL is now becoming more aware of the importance of ESP, and there is a move underway to establish a special interest group within its ranks to deal specifically with this area. Evidence of this growing interest was seen in the 1978 TESOL convention in Mexico City where a number of papers on ESP were given. The International Communications Agency of the U.S. government, which sponsors bi-national centers

for English teaching abroad, is also taking an interest in ESP. This can be seen in its sponsorship, along with the Ford Foundation and the Center for Applied Linguistics, of summer workshops in ESP in North Africa in 1977, and in other areas of the world as well.

This growing American interest in ESP around the world can be seen in Saudi Arabia where American ESP programs are probably in the majority in both university education and in industry-related programs. Until very recently most private sector ESP programs in Iran had been staffed and operated by Americans. The huge helicopter school program, sponsored by Bell Helicopter of Texas, is a good example of this. In university education there have been two major ESP efforts in Iran, one by the University of Illinois at Tehran University, and another by the British Council at Tabriz University. So it appears that in at least one Middle Eastern country ESP has been divided between British and American specialists.

In Southeast and East Asia the ESP field seems to still be dominated by the British primarily because of the work of the Regional English Language Centre (RELC) in Singapore which is heavily dominated by British mentality and methodology. In recent years, however, American input has been actively sought by RELC, resulting in a number of American papers being delivered at the annual RELC seminars, and in the employment of visiting American scholars such as Edward Anthony (former president of TESOL) at the centre.

Latin America is heavily influenced by the British in the area of ESP, notably in Mexico and in Chile. It is curious to note here that while British linguistics has sought to view other varieties of English, such as Indian or African English, as legitimate expressions of the English language, they have done little to try to eliminate the old notion, still prevalent in Latin America and other areas, that RP speech (i.e., Received Pronunciation, or the British Standard), has more prestige and is more desirable than standard American English. This omission by the British is at least partially understandable when one realizes the importance of the large investment in terms of time, manpower, and money that they have so far put into EFL and ESP programs around the world.

Now that we have established what the general trends are that have given rise to ESP, we will do well to look at what the educational manifestations are, in terms of program types, that this movement has created within the English language teaching community.

Two recent articles by Peter Strevens, the British applied linguist, go to great lengths in describing the various components of this rapidly growing field of ESP (Strevens 1977a and 1977b). Strevens points out that in recent years there has been a pronounced movement toward student/learner-centered instruction and away from teacher and specific text centered programs. He claims that this general movement in foreign language education has led both theoreticians and methodologists to look toward the individualization and specialization of course content in the English teaching field. Instruction based on these forms demands that teaching should be designed to adequately deal with the exact needs of the learner. He claims that it is this new type of learner-centered orientation in ESL, combined with the expressed needs of people around

the world, that have provided the initial basis for ESP programs (Strevens, 1977b).

As we shall now see, ESP courses can be divided into a number of different types depending upon the needs of the learners involved. "Broadly defined, ESP courses are those in which the aims and the content are determined, principally or wholly, not by criteria of general education (as when 'English' is a foreign language subject in school), but by functional and practical English language needs of the learner" (Strevens, 1977a). Within this wide definition, we can fit courses for businessmen, lawyers, doctors, various scientists, air traffic controllers, even educators. In other words, there could be ESP courses designed for just about any profession or trade that requires such instruction.

An early distinction which many writers, including Strevens, make at this point is that between general ESP, as defined above, and English for Science and Technology (EST), there is a necessity to incorporate within EST coursework a greater content of what might loosely be defined as scientific English. Among the qualities that characterize scientific English, there are some which set it aside as a very special case. First of all, ways of quantifying things are very specialized, and the formulae and symbols of science in English almost constitute a separate language themselves. Strevens points out that scientific English also employs a large body of discourse that relies heavily on the use of Latin and Greek roots and affixes. In the area of vocabulary, each specific course in EST is going to have a course specific lexis determined by the particular area of science or technology. Along with this, Cowan has pointed out that on another level of vocabulary EST is characterized by a common core of what might be called "subtechnical vocabulary" that appears in many EST curricula and is not subject specific (Cowan, 1974). For example, carcinogenic, cardiac arrest, pulmonary artery, orthopedics, etc., would be included in an EST course for doctors or medical students, but not for computer scientists. On the other hand, words like function, operation, isolate, supposition, formula, etc., are part of a body of lexis that is common to both Medicine and Computer Science. This common lexis is what is meant by subtechnical vocabulary. This work by Cowan on lexis and structure in EST will be reviewed later on in this paper. Another of the qualities of scientific and technological discourse in English that will also be treated later is the special rhetorical structure of scientific English. During the rest of this paper, ESP and EST may be used interchangeably, unless exactness dictates using one instead of the other. As pointed out already, however, EST is a major component (if not the major component) of the overall ESP picture.

In general ESP courses are divided between occupational and educational courses. Occupational ESP is job related and can be of a highly technical nature or it can be rather simple in nature. For example, English for airline stewardesses, weathermen, laboratory technicians, etc., are all occupational ESP. Strevens gives three different orientations to occupational ESP. First of all, he says that there are courses based on "pre-experience" where the learners are already familiar with a job and where they are adding a relevant knowledge of English to their already existing job skills. Secondly, he defines what he calls "post-experience" based courses. In these courses the learners are learning the requisite English for their job at the same time that they are learning the job itself. Finally, the third occupationally-based ESP type course that he talks about is teacher conversion, or retraining courses.

Because of a very serious need for ESP teachers Strevens says that courses such as these are needed to take present standard ESL teachers, and other foreign language teachers as well, and "convert" them into ESP teachers with a general knowledge of science, technology, etc., worked into an ESP teacher-training format (Strevens, 1977a). Aside from teacher conversion programs, most of these occupational ESP programs would probably be business- or industry-based courses.

Educational ESP varies greatly according to the educational aims of the institution in which a program is offered, and also as a result of the framework and levels of education within which courses are offered. As opposed to regular university level EFL courses Strevens calls this "English for academic purposes," which is related to the study of a particular discipline such as chemistry, earthquake engineering, math, etc. This "discipline-based" approach is greatly affected by two questions: first, have the students already completed their study of the discipline, or are they learning English as a part of their study? Strevens labels the first type "pre-study" and the second type as "in-study." He then makes a very interesting point about how to approach these types of courses in a general way when foreign students come to an English-speaking country (in this book *England*), "One very numerous body of overseas students in Britain, often referred to as 'pre-technical' students consists of those who are learning English specifically in order to gain admission to a course in science or technology: for such students ESP needs to include a major component of study skills" (Strevens, 1977a). These study skills would, of course, complement the discipline-based ESP materials and would hopefully show the student what to do with the English he learns in his present or future academic environment. Adoption of suggestions such as this would radically alter the approach to English that we have for foreign students in the U.S., where most intensive English language programs still follow audio-lingual guidelines, and in general avoid discipline-based approaches to the training of either incoming or already enrolled foreign students. Perhaps colleges of Engineering, Agriculture, Medicine, etc., on major campuses should consider discipline-based courses for their foreign students. Another approach to solving this problem here could be by placing intensive English students in classes not only by the amount of English they know, but also according to their fields of study as well. It seems that either of these approaches would better serve the students than what is done now.

The second distinction to make within educational ESP is that of school subject ESP. This seems to fit into what would be equivalent to a junior/senior high school curriculum in this country. In the country where ESP is a school subject Strevens distinguishes between independent and integrated courses. The independent courses are where English is offered as English as a foreign language, but where the EFL course is taught in say a geography or general science framework (i.e., a good deal of the grammatical work, the reading passages, and attendant exercises are placed in the framework of a discipline). The integrated program is where English is combined with Math, General Science, and other courses in one integrated syllabus. Here these particular courses are integrated with English to such an extent that after the elementary level the courses are actually taught in English for the rest of the learner's time at that school. A good example of this is a system of government operated, but tuition supported, special secondary schools in

Turkey where, from the seventh through the twelfth grades, English, Math, and the sciences are all presented in an integrated English curriculum.

Having developed the concept of ESP, and the typology of programs within the field, we turn now to a discussion of how ESP programs are established and implemented. Cowan (1977) sees four elements required for this: (1) needs assessment, (2) materials development, (3) teacher preparation, and (4) evaluation. Now it can probably be argued that these steps should be part of the establishment of any well thought out educational program. So what is so special about using them specifically for ESP programs? Perhaps the most compelling reason for this is the previously mentioned fact that ESP is a fairly new, rapidly growing branch of the ESL profession, and it is now that these types of sensible guidelines have to be established. If one follows the ideas of Strevens stated above, and the theory of functional language use that underlies such ESP pedagogical frameworks as Wilkins' *Notional Syllabuses*, then needs assessment is crucial for the beginning of any ESP program. It is in this stage of program development that both institutional and learner needs can be identified. I am sure that it must be obvious that in learner centered instruction this is an indispensable first step. This needs assessment provides the basis for the next component, materials development. It is in this stage that the coursework is developed to meet the assessed needs. This component is also very important to ESP because so many of the new programs in this area need materials developed that will be specifically tailored to their requirements. This points out a problem that Strevens did not address, and that is the training of materials developers (a good teacher is not always a good materials developer, and vice versa). As of now adequate training in ESP materials development is not given by most MATESL programs, whether they be in England or in this country.

The third stage of program development, teacher preparation, is very important also. The best trained group of ESL teachers will find it tough going if they are not properly prepared for an ESP assignment. As I see it there are two types of preparation that have to be considered. The first is general ESP teacher preparation within the framework of an academic ESL teacher training program. Here student-teachers could at least be presented with the general theories of ESP, and be exposed to the various types of programs that have been developed. Secondly, pre-program teacher orientation sessions should be planned for specific ESP programs that will enable the teachers to get a grasp of what is required of them as a result of the special needs of their students and/or of the institutions that is employing the teachers. These two approaches to teacher preparation would go a long way in more properly preparing ESP teachers. In this country academic training in this area is sorely lacking, and it is only just beginning in England (Strevens, personal communication).

The final, and very crucial, component to consider in both the development and implementation of an ESP program is the place of evaluation in the program. According to Bachman (1978), serious efforts in incorporating evaluation into ESP programs are lacking. He points out that while most programs acknowledge the need to evaluate student proficiency or achievement, there are almost no descriptions or explanations of evaluation methods or results in such programs. He claims that most ESP project directors see the weaknesses in this area of evaluation and are beginning to work on the problem. He makes the interesting point here that evaluation is not testing and measurement per se; he says,

"Evaluation, essentially, is the collection and use of information for the purpose of decision making" (Bachman, 1978). Testing and measurement, he implies, are two of the ways (but not the only ways) to gather this needed information. It follows here then that the standard techniques of formative evaluation, summative evaluation, and the like must be incorporated into the planning, execution, and conclusion of good and well balanced ESP programs. A model similar to this one has recently been developed by Joe Darwin Palmer (1978), and it will be treated in detail in the conclusion of this paper.

We have seen what the state of the art in English language teaching is today, what ESP is, and what considerations must be accounted for in ESP program development. In the following section we will look at various models in ESP research and their implications for materials design.

1. LINGUISTIC RESEARCH AND ESP

Recently an article has appeared that has shed light upon the contributions of applied linguistic research in the study of ESP. In 1976 Lee Kok Cheong published an article at the Regional English Language Centre in Singapore entitled "Trends in the Linguistic Study of English for Science and Technology" (Cheong, 1976). Cheong makes the point early on that the tremendous expansion of technology and science in the developing world has led to the recently rapid growth of the phenomenon of EST. He says that because today's applied linguists are interested in language as communication, EST research has become very attractive to them. He puts this into perspective by quoting British applied linguist Henry Widdowson who said, "The clarification which applied linguistics provides comes about as a result of relating the language teacher's beliefs about the attitudes to language and language learning, as they are revealed by his pedagogic practices, to the linguist's and psychologist's discoveries about language and learning by means of theoretical and experimental investigation" (Cheong, 1976).

In discussing the linguistic trends in studying EST Cheong divides his article into four parts: "(1) Pre-linguistic, traditional attitudes to the language of science, (2) linguistic analysis of the lexicon, (3) linguistic analysis of the syntax, and (4) discourse analysis" (Cheong, 1976).

He points out that traditionally English teachers considered the language of science to be rather cold and inexpressive. The English language was taught in most overseas universities as a Humanities subject which could later be applied to the learning of science, but Cheong states that this approach created what amounted to two English language cultures, one expressive of science and the other expressive of the rest of the milieu of English. Cheong feels that the major contradiction that arose for the student during this period of time was that what was held up as good, clear writing in the science classroom was criticized in the language classroom as being a stylistically weak use of the language. Also during this time (pre-1960's), Cheong claims that linguists kept themselves separated from language teachers, and saw little relationship between their work and the classroom practice of the teachers.

The first group of individuals that attempted to change this situation was not, as might be expected, the linguists, but rather the scientists and

teachers. This change in attitude revolved mainly around the special structure and meaning of scientific vocabulary. This approach to scientific English began in the 1940's and 1950's, and it viewed the study of scientific lexicon on three general levels: "(1) ordinary language, (2) scientific language, and (3) intermediary (sub- or semi-technical) language" (Cheong, 1976). Cheong claims that the first level of ordinary language that contains common content words, function words, etc., may be the most difficult for the student to grasp because of their generality of use throughout the English language. The second level of scientific language looks complicated on the surface because of its many Latin and Greek roots and affixes. This is what some call the language of scientific classification or taxonomy. The language of a discipline such as mathematics would also be included here. Cheong hypothesizes that this may be the easiest level of lexis for the student to acquire because "learning the meanings of such words as carbohydrate, molecule, duodenum, aorta, etc., is an automatic consequence of studying the discipline which uses them" (Cheong, 1976). The third level which Cheong calls intermediary, or subtechnical, language may not prove difficult if the terms are learned within the context of the discipline that the learner is studying. He defines this type of language as terms taken from non-technical areas that are given technical meanings such as "eye of a storm," "teeth of a gear," etc. As mentioned above, Cowan has a different interpretation of the term subtechnical vocabulary. It will be seen below how he treates subtechnical vocabulary as a component of ESP materials design.

The greatest contribution to English language teaching of those who took an interest in scientific lexicon was the publication of word frequency counts in the English language. The two best known of these lists are the ones by Kucera and Francis, and by Michael West. The problems with these lists will be discussed later; however, it is enough to say here that their focus is on ordinary language and not scientific lexicon.

During the pre-eminence of structural linguistics in the 1950's and 1960's there was great emphasis on the surface structure of language. This led some applied linguists to do for scientific syntax what West, Kucera and Francis, and others did for scientific lexicon; namely to make frequency counts of the structures that occur within various chunks of scientific prose and then to arrive at a description of the characteristics of scientific English based on those counts. Cheong feels that this tended to oversimplify the syntax of scientific English by restricting it to a set of manageable patterns which were simple and considered to be essential for language learning. The problem with this is that the English language provides us with many ways, sometimes, of expressing the same thought. Cheong (1976) gives the following example to illustrate this point:

> "1. Sodium and chlorine have respectively one too many and one too few valence.
>
> "2. Sodium has one too many and chlorine one too few valence."

Here we see two ways of communicating the same fact, but the equivalency in meaning is not apparent from the two surface structures.

The advent of transformational-generative grammar spurred the researcher to develop a rigorous method for displaying the syntactic operations of language. The function of syntactic rules can be seen as that of a link between concepts or deep structure and surface structure. Hence structuralists, who only look at surface features, miss many significant relationships in English. The transformationalist could take Cheong's example, quoted above, and show how different surface structures are related. Similarly, other important insights of this type have only come to light as a result of transformational research. For example, it has been shown that many pre-nominally modified noun structures arise from the same deep structure as do certain relative constructions. In face the pre-nominally modified structure arises from the relative construction, as in the following:

1. We went to the conference that was in Shiraz.

2. We went to the Shiraz Conference.

Structuralism cannot account for this synonymy.

Recent studies have been done on the syntax of scientific English within a T-G framework. One of these studies that will be reviewed below, along with other models for ESP research, is that one done by Cowan and his associates at the Tehran University Language Center. Cheong points out that though very thorough, Cowan's study was based on discrete points, and that most T-G based applied linguists ignore the interaction among sentences in connected authentic discourse.

This brings us to the fourth, and current, trend in the study of EST, that is discourse analysis. This trend has arisen at the same time that pedagogy has become more focused on communicative competence. Discourse analysis focuses on describing the network of linguistic relationships intersententially and in paragraphs. In this area applied linguists are studying the structural elements, such as anaphoric relationships, connectives, and reference that create "grammatical cohesion" in English. It is the contention of researchers in discourse analysis that various rhetorical modes such as classification, definition, process, etc., are expressed through a system of what Cheong calls "interrelated linguistic elements," (Cheong, 1976) and that these elements demand certain grammatical choices. Discourse analysis emphasizes the reader's ability for prediction, recall, retrieval, synthesis, and for the critical assimilation of information. As such it bears a resemblance to the work that reading experts like Kenneth Goodman and Frank Smith are doing in the psycholinguistic aspects of reading English. Specific ESP research in discourse analysis will be treated later when the work of the American applied linguists Lakstrom, Selinker, and Trimble are discussed.

This concludes our treatment of the linguistic trends that have had and are having influence on EST. As we have seen the trends vary widely, but it does not mean that one is preferable to another. As Cheong has pointed out, a comprehensive description of EST which is so necessary for the design of meaningful ESP courses, could involve syntactic (textual) as well as discourse analysis.

2. CASE STUDIES

We will now turn to a review of some of the EST text materials that have been written during this decade. As was previously mentioned, ESP programs and textbooks are proliferating these days in the English teaching field. We must remember that these models were designed to meet different EST/ESP needs, and because of this they may differ greatly. "The model" for developing ESP materials cannot be developed because of the special, or specific nature of each program. Still, as we shall see, this has not precluded researchers from developing general elementary programs which stress the teaching of English within a scientific framework. Also, we will see at least one example where a writing program was developed for the faculty of science at a particular university, and then that text was redeveloped into a scientific writing text that is supposedly usable on a world-wide basis (Swales, 1971).

In a 1974 article in the *TESOL Quarterly*, Cowan presents a description of the work done by him and his research team in developing a special purpose EFL course for medical students at Tehran University. Cowan and his team began their research in 1972 and by 1974 they had produced a two-volume text designed to teach basic medical English to first year medical students. Cowan and his researchers were really pioneers in this area of ESP in American ESL. When they began their work at the Tehran University Language Centre (TULC) they had no previous texts to guide them and precious few theoretical guidelines in the area of ESP either. They began by recognizing that they were starting from scratch, and they took as one of their major theoretical guidelines Eskey's 1971 article in the *English Teaching Forum*. In that article, one of the earlier general articles in American ESL that began to deal with ESP problems, Eskey isolated two major linguistic problems for non-native speakers of English in processing English discourse: (1) vocabulary problems, and (2) structural problems (Eskey, 1971). These two areas of lexis and syntax formed the major areas of research for the team.

It should be mentioned here that there are other non-linguistic factors that had to be considered throughout the text writing process. The three most important of these that were dealt with according to Cowan were: "(1) Persian students' inability to process sentences in phrase units, (2) their inability to make generalizations and inferences based on what they have read, and (3) problems in comprehension due to the cultural context of the materials" (Cowan, 1974). These are, of course, not problems specific to ESP teaching in Iran, but to all foreign language teaching there, and were very important in guiding the team's overall research effort. It is important to note here something that was alluded to previously, namely that in ESP research of this kind the researchers must take into account the extra-linguistic factors that influence the language acquisition process of the learners for whom the course is being designed. This "tailoring" of a course to a group of learners, to meet their specific needs, is really one of the most important aspects of the whole new ESP movement.

Following Eskey's approach then the first linguistic problem addressed was that of vocabulary. The question was: What type and amount of vocabulary should be presented to first year (18- to 20-year old) Iranian medical students who would take a medically-oriented English course for two hours a day, five days a week, for an academic year of two standard semesters? The common service

lists of the most frequently occurring words in English, on which the vocabulary in many ESL texts is based, were found to be rather inadequate. As previously mentioned, they contain what Cheong called "ordinary language." The Cowan group found them to be rather inadequate because they contained few references to the subtechnical vocabulary necessary to understand medical prose, let alone mentions of strictly medical terminology.

At this point I would like to briefly redefine the term subtechnical vocabulary that Cowan developed. Cheong defines it as "borrowed words from non-technical spheres" (Cheong, 1976); however, Cowan defines subtechnical vocabulary as "context independent words which occur with high frequency across disciplines. Examples would be items like: function, inference, isolate, relation, basis, presuppose, simulate, approximately etc." (Cowan, 1974). This is a more exact definition of subtechnical vocabulary, and it was explained earlier.

What the research team did then was to develop their own list of subtechnical and technical vocabulary based on a computer analysis of over 100,000 running words of English language medical prose. The vocabulary was then ordered in terms of the frequency in which it appeared. Incidentally, the correspondence between this frequency list and the so-called standard lists was so low that it clearly points out the need for such analysis when preparing ESP materials.

After this lexical analysis was completed, the second major half of the research that led up to the preparation of the text was undertaken, and that was a syntactic analysis of the same sample of over 100,000 words of medical discourse that was used for the lexical analysis. (By the way, this discourse was drawn from a number of medical textbooks and professional journals.) The previously developed computer program was modified to fit a structural analysis. The end product was that each sentence in the running discourse was isolated on the computer printout as a separate entity, as with the lexical items, but here the structure of the particular sentence was also listed, and a tabulation was made of how many times certain structures appeared in this string of discourse.

The next step in this research was the organization of the data, and the implementation of the results of the research in the form of ESP text development proceeded with a number of important considerations coming into play. Among these guiding considerations was the careful selection and adaptation of reading passages for the proposed text, based upon the completed lexical and syntactic research. Then certain types of exercises for structure, vocabulary, and reading comprehension had to be devised. When finalized, the form of the individual units and occurrence of the exercises and reading passages stayed the same throughout the material (i.e., the physical plan of each unit does not vary significantly from unit to unit).

The final product was two volumes containing 14 lessons overall (each lesson was divided into two units). Commonly occurring structures appear in the early lessons. For example, the passive voice, common in medical English, is taught in lesson 2 (i.e., units 3 and 4). This is in sharp contrast to most general ESL programs where the passive is not taught until about the final 33% of the structure course. So we see the students being exposed to common, necessary structures for medical English early on in the course. As a point of

clarification it should be noted that all these Tehran University medical students had studied English for six years in secondary school, but this should not be taken to mean that their English was good. A great deal of classroom time in situations like this has to be spent in undoing the mistakes of their secondary school instruction.

This plan for the development of this project followed the main points outlined earlier by Cowan, and below by Palmer, that are necessary steps in good ESP program design. A needs assessment was done in order to determine what Tehran University medical students needed, i.e., a reader to develop basic skills for reading Medical English, given the short time available for instruction (2 hours a day per week, over the course of an Iranian academic year). Text analysis was done to discover the special nature of the lexis and syntax of Medical English. Discourse factors were not specifically dealt with because research in this area that might have provided a theoretical framework was still in its infancy. Finally, formative and summative evaluations were done, and the formative evaluations of each lesson in the pilot text were used to refine the final product.

The next ESP course that I would like to discuss is the one developed at Tabriz University in Tabriz, Iran, by the British EST specialist Tony Dudley-Evans and his associates. The general situation that these people faced at Tabriz University was by and large the same that Cowan's group was confronted with at Tehran University. The Dudley-Evans group also found that although their students had studied English for six years in secondary schools, their English was far from adequate when they entered the university; however, they did need to learn enough English to read books in their specific fields, and to comprehend occasional English lectures. One possible problem that Dudley-Evans et al. do not mention in their article describing the development of the EST program at Tabriz University is the fact that the vast majority of students at that university are not native speakers of Persian. Most of the people in that part of Iran are speakers of a dialect of Turkish which is structurally quite different from both English and Persian. The students all had received their primary and secondary educations in Persian and therefore were in the position of learning English as a third language. Although the students' Persian must have been fluent enough for university work, the fact remains that in the province of Iran Turkish is the language of both social and commercial intercourse, and Persian the language of education. It would be interesting to know what, if any, linguistic problems this might have caused for the students. Furthermore, one wonders whether it was necessary to take this fact into account when designing materials, and teaching in the classroom.

This group of researchers began their work with the goal that their materials "would have to provide the students with the language and strategies they need to read scientific texts at the undergraduate level in their major subjects, and that the minimum objectives should be the developing of the grammatical, conceptual, and rhetorical competence of the students" (Dudley-Evans et al., 1976). Unlike the Tehran University situation, students in technical fields at Tabriz University were required to do two years of English. The research team therefore designed a set of first-year and second-year materials. Like the Cowan materials the first-year lessons were divided up into a two-unit sequence, but with a major difference. The Tehran University materials built up structure and vocabulary throughout the two-unit sequence, and this

culminated in a major length reading passage. In the Tabriz materials, however, such lengthy reading passages were left to the second-year course and the first-year course consisted of twelve units of English as a foreign language taught within the framework of general science. Then there follow 12 additional units of study which are specific to the students' areas of study. Dudley-Evans makes it clear that in these units the English teacher is not teaching the specific scientific discipline, like Biology, Engineering, etc., but rather he is teaching the English used in those specific areas of study. He states that the team took pains not to encroach upon the instructional domains of any of these subject areas.

The units from the general science part of the course and the discipline specific part of the course were taught in tandem, i.e., unit one of the general course was coordinated with unit one of the specific course, and so on. The general course was the same for all students involved irrespective of their fields of study. Dudley-Evans et al. point out that this tandem teaching of the two parts of the course is one of its strong points in that the students continually see the application of general scientific English applied to their areas of interest from the beginning to the end of the course. The general course and the specific courses have various objectives. The aim of each general unit is to: "(1) Introduce a new area of conceptual content which we refer to as concept. (2) Focus on 'semi-technical' English" (their term for sub-technical vocabulary). "(3) Provide situations which are generally relevant to science; that is, either situations from science with which the students should be familiar, or more general situations which can be exploited for the purpose of practising scientific English, e.g., describing a bicycle. (4) Encourage active participation by the students in using language in these situations." Each specific unit tries to: "(1) Develop the concept and the related semi-technical language of the corresponding general unit along with specific language items from the specialist subject which are related to the concept, and (2) provide greater emphasis on reading and intensive listening" (Dudley-Evans et al., 1976).

Before briefly commenting on the second-year materials it is necessary to define this term of "concept" that the authors use. In organizing their materials, i.e., in grading them for the order of presentation, they claim to have done some kind of work with structure, but they do not mention what they did. Even after looking at the textbook *General Science* one is still in somewhat of a quandary about what type of methodology was used in deciding which structures to teach and when. What Dudley-Evans et al., and another of their colleagues, Martin Bates (Bates, 1978), spend time discussing is justification of their approach of basing each of the general units around a "concept." I am sure that this approach was dictated by their adherence to a belief in teaching the functional, or notional, aspects of language. The functional/notional approach to syllabus design and teaching is a system of L2 instruction that is very popular in Europe now. This syllabus design plan has been popularized by D.A. Wilkins in England, and its guiding principle is that communicative competence be the goal of L2 instruction at all levels (Wilkins, 1976). The functional element of a syllabus like Wilkins' model is concerned with such things as who the learner is, the setting (social or professional) where he will use the language under study, etc. These functional units were organized by "basing each unit on an important scientific concept, such as structure, proportion, causation, etc." (Bates, 1978). Bates points out that while these and other

concepts that were chosen were important to science, they were not exclusively the property of science, and therefore were readily understandable to the English teachers who were by and large liberal arts graduates. Bates makes no apology for how the concepts were arrived at, in fact, he candidly points out that "the key concepts which formed the notional basis of the course were arrived at mainly intuitively from the experience of teaching scientific and technical texts for some years" (Bates, 1978). If I may be allowed a brief value judgment here, I would like to say that this does not seem to be a very scientific approach to writing a course in Scientific English, and yet the general lessons developed in Tabriz are now circulated around the world in the book *General Science* by Dudley-Evans and Martin Bates.

Finally, the second-year materials have not yet been developed as much as the first-year units. These second-year courses contain only units with specific subject content, and no general lessons as was the case with the first-year materials. It is claimed that by the second year the students should be familiar with the concepts of science and the structures that express them. The rhetorical organization of English discourse is stressed in these materials, and each unit attempts to: "introduce a new rhetorical act, (2) practise grammatical and lexical items associated with that act and the ways in which they signal it, (3) illustrate the relation of rhetorical acts together with aspects of textual and logical cohesion by various exercises and by reference to actual discourse" (Dudley-Evans et al., 1976). The standard rhetorical modes of Definition, Classification, Description, and others were chosen to replace a "concept" as the central theme of each unit. Again, as with concepts, the choice of selecting and grading the rhetorical modes seems to have been somewhat of an arbitrary process.

It was here in the second-year courses that much more emphasis was placed on the reading skill, and therefore longer passages of authentic scientific discourse were possible and were presented to the students in each unit. The nature of the second-year materials (i.e., as a reading oriented course of study) seems to have caused a squelching of some of the first-year course enthusiasm that the authors claim that the students had for the course. Dudley-Evans et al. state that "because of the greater focus on reading, the productive participation of the students characteristic of the first-year course was not always maintained. This may be inherent in reading courses as the use of actual discourse involves high vocabulary loads and this can imply a more passive role for the student" (Dudley-Evans et al., 1976). I would like to say that this view of a reading centered course need not be the situation. The authors should take an active view of the reading process rather than a passive one, and should constantly be reinforcing this as a challenge to the students. This should be done in an indirect manner, and hopefully it would give the student a much more positive view of the reading process.

The two efforts at EST materials development that we have looked at so far have been primarily concerned with the teaching of scientific reading in English. The third and final attempt at EST course design that we shall discuss focuses on the writing skill, aptly enough this text is called *Writing Scientific English*, and it was prepared by another British ESP expert, John Swales.

Swales was the head of the English department in the Faculty of Engineering of the University of Libya in Tripoli from 1966 to 1970. His textbook

Writing Scientific English (WSE) was the product of a four-year effort on his part to develop a technical writing program to meet the unique needs of first- and second-year students in the five-year undergraduate course of study in Engineering at the University of Libya.

The first-year students that Swales dealt with were similar to the Iranian students mentioned above. They came to the university with six years of secondary school experience in English, and their principal study skill in approaching a learning situation of any kind was that of rote memorization. Like their Iranian counterparts they also had a generally poor level of English, particularly in the so-called productive skills of speaking and writing. What made these students different from others in standard Middle Eastern institutions of higher learning was that they were required to do some coursework and laboratory work in English right from their first year of university instruction. It was this situation that led Swales to develop the policy for his department that the reading and listening skills required for successful coursework would be developed, despite any particular EST instruction, by the students themselves out of the necessity to prepare for their courses and to understand the lectures presented to them. He also admitted that he and his colleagues had more knowledge about the testing of reading than about the problems of teaching it within a scientific framework. Since Swales and his staff were, as are most ESL teachers, liberal arts oriented he also felt that they could much better manage the instruction process if they stressed the speaking and writing skills. In a recent article about the development of WSE he gives three reasons for the adoption of this rationale: "A writing/speaking orientation would allow us to keep rather more within our scientific depth. The more confidence we could give the students in their writing ability, the less likely they would be to fall back on the educationally unsatisfactory procedure of learning paragraphs and pages from their textbooks by heart. We had a good enough staff-student ratio to be able to correct the students' work, and we could use the lab (i.e., language lab) for remedial work on the recurrent grammatical errors" (Swales, 1978).

With this assessment of the situation he began the four-year process of developing his materials. Because this text was developed in the late 1960's the theories behind such linguistic tools as discourse analysis and functional/notional syllabuses were not available to him. Yet he based a number of his units around the various rhetorical modes necessary for scientific communication, and the attendant structures that this communication requires. Other lessons in WSE are presented within frameworks of various scientific and technical skills that the students had to be conversant with such as the interpretation of tables and graphs.

No scientific analysis of lexicon and structure after Cowan was done, and there does not seem to have been any systematic study of the concepts of science such as Dudley-Evans et al. did. On the other hand, Swales defends the overall strength of his work because it was developed over a four-year period of constant trial and error testing of the lessons in actual classroom situations at the University of Libya. There is nothing strange about the way this was done either. If lessons failed they were revised and retaught until they were acceptable, of if they were repeatedly ineffective they were eliminated.

The structures taught in the text were not graded from simple to difficult in conformity with some predetermined cline of linguistic difficulty. Instead, structures were selected as they were needed in order to give the students the necessary grammatical tools to express themselves in the various rhetorical modes of scientific prose, and also to enable them to successfully deal with the different scientific and technical skills that they were learning. This trial and error situation points up a very interesting fact about EST materials development, namely the time element involved in such work. If a team of EST program developers have four or five years as Swales did to prepare a course of study, then perhaps the constant trial and error approach to such materials preparation can be very effective. There really is nothing that "fine tunes" materials more than classroom pilot testing. On the other hand, and this is becoming prevalent today, if an organization requires the preparation of course materials within a limited frame of time, say a year or eighteen months, then it seems reasonable to suppose that the materials would have to be based on some kind of a predetermined cline of structural and lexical difficulty that emerged as a result of an initial scientifically oriented linguistic study of the discourse of the discipline that would provide the framework for the EST course.

We have seen above representative samples of three major approaches to EST materials development. Cowan's work was formed around a transformationally-based analysis of the functional language of medicine. Dudley-Evans et al. also used a notional/functional approach in developing their materials, and they also relied to some extent on discourse analysis in the designing of their second year reading materials. Finally we have seen that a talented group of researchers and teachers who have enough time for the completion of their task can prepare very satisfactory EST materials by the trial and error method in the classroom. The "time-luxury" inherent in this approach reduces the course developers' dependency on any single methodological approach to materials preparation.

Articles containing detailed descriptions of the development of the whole ESP/EST discipline and articles describing individual course development are now becoming popular in the theoretical and practical literature of English language teaching. In this regard three anthologies on ESP/EST require brief mention at this time. The first two are British offerings, and the third is an American publication. The first of these is *Teaching English for Science and Technology*, edited by Jack Richards. This is a collection of papers delivered at the Tenth Regional Seminar of the Regional English Language Centre (RELC) in Singapore in 1975, and the book came out in 1976. It is one of the earliest EST anthologies and it deals with a number of EST-related areas. It is divided into four parts that deal with linguistic analysis, lexical study, materials development and teacher training, respectively. The strength of the volume is in Part III where seven articles on materials preparation and course organization are presented. The articles by Cheong and Dudley-Evans et al. previously referred to, are found in this book. I have dubbed this book a British offering simply because RELC is very heavily influenced by British methodology, because Richards is British, and because with possibly two exceptions the papers presented were written by British authors or British-trained people at RELC. One exception to this that I will discuss in the next section is an article presented by the American team of Selinker, Todd-Trimble, and Trimble.

A second excellent British anthology is *English for Specific Purposes*, edited by Ronald Mackay and Alan Mountford. Published by Longman in 1978. this book is divided into three parts: (1) general problems of EST, (2) approaches to textbook design, and (3) case studies. The two articles cited above by Swales and Bates can be found in Part 2 of this text. Again its strength lies in its inclusion of eight out of its ten articles in the area of course or syllabus design. The major weakness of this and the Richards anthology is that the area of teacher training and future research needs in EST are treated cursorily or ignored.

Finally "Language for Special Purposes," Special Issue of *Studies in Language Learning*, edited by J.R. Cowan at the University of Illinois, contains articles on the teaching of Russian, German, and French for special purposes as well as two very good articles that deal with ESP. One of these, by Peter Strevens, has been quoted extensively in this paper. Near the end of his volume Cowan also provides the researcher and teacher of ESP/EST with a very valuable fourteen-page bibliography of the field. A follow up issue to this should be attempted that would deal only with ESP/EST.

3. REQUIREMENTS FOR ESP COURSE DESIGN

As has been seen above there are a wide variety of approaches to ESP course design; some rely on text analysis (Cowan), discourse analysis (Dudley-Evans et al.), and some use an admittedly "hit and miss" approach (Swales). From these examples and after reviewing the various approaches to course design it is rather evident that two major components in governing ESP course design have been lacking until now. These two elements are a definite structural approach for a sequenced schema to be used in overall ESP course planning, and a strong theoretically-based curriculum design model for materials development in such programs that would focus on client (i.e., student) needs.

The first element mentioned above, a sequenced schema for ESP course planning, could take many directions, but a seemingly very useful attempt at developing such a schema has been recently proposed by Joe Darwin Palmer in the December 1978 *TESOL Quarterly*. Palmer makes the point that the components of his schema are not all new, but it is just that because ESP is a relatively recent phenomenon that such an ordered approach is needed at this time to guide the development of what most experts feel will be a great number of English courses in this area. The steps that he feels should comprise such a schema are as follows: "(1) Needs Surveys, (2) Textual Analysis, (3) Discourse Analysis, (4) Methodology and Syllabus, (5) Formative and Summative Evaluation, and (6) Modification of Methodology and Syllabus" (Palmer, 1978).

Needs assessment is the first, and possibly the most important, step in the schema. It is here that information must be gathered so that the course planner can precisely identify who the learner is (i.e., his age, occupation, previous training or education, career goals, to what use he will put the language when he finishes the course, etc.). Consideration of all of these, and other factors, is the basis of the learner-centered ESP course. The needs of the learners will also determine the methodological approach of the course. For example, if the needs of the students were focused on reading then a linguistic methodology such as that used at Tehran might be preferred. If the course were

to be geared to teaching air-traffic controllers the English of their profession, a functional methodology (after Wilkins) might be used. Finally, suppose a communicative approach to the language is needed in a situation, for example, where foreign doctors need to be taught how to interact with their patients; here a socio-linguistic approach could be taken in order to teach the doctors "how" to talk to people using not only linguistic but also the para-linguistic devices essential for communication. Needs assessment then, shows the ESP program planner exactly what has to be developed in order to meet the specific needs of the learner. This first step in ESP program planning is crucial, and the other steps in the schema naturally follow from it.

After a general and thorough needs survey is completed, a textual analysis of materials in the learners' field must be undertaken. Textual analysis shows the ESP program developer what it is about texts, syntax, lexis, etc., that cause difficulties for the learners with relation to the skills that they need in English. This step involves the analysis of text materials in context and experimental testing to see just what are, or are not, problems for the ESP student. For example, one would have to determine in a scientifically-oriented program whether or not scientific prefixes and suffixes cause problems for the learner, as Cheong maintains above. Another possibly important area of research to consider here might be whether or not derivational morphology (i.e., word family relationships) cause problems for the learners. Finally a very important aspect of this step is the isolation, through research, of those items that are necessary for the students' appreciation and understanding of what kinds of devices give cohesion, i.e., texture, to an English language text in their field. A major contribution to providing a model for this type of research has recently been published by Halliday and Hasan (Halliday and Hasan, 1976).

The third step in this schema is discourse analysis. It is here that the rhetorical features of the styles or registers under consideration are identified for the purpose of being integrated into the curriculum (syllabus) design. The most thorough work done in this area is that of Larry Selinker, John Lakstrom, and Louis Trimble at the University of Washington. These researchers have written many appealing articles that deal with the rhetorical nature of scientific discourse. Among the basic rhetorical modes of English they state that classification and definition are very important for the writing and understanding of scientific English. In 1976 Selinker, Todd-Trimble, and Trimble published a very interesting article entitled "Presuppositional Rhetorical Information in EST Discourse" (Selinker et al., 1976). The basic conclusion of this article was that when information in either of the modes of classification or definition is explicit then most ESL students have little trouble with it, but when such information is implicitly indicated throughout a passage most ESL students find such information difficult to process. Why is this so? Selinker et al. do not tell us, and herein lies one of the major weaknesses of their approach to discourse analysis, a severe lack of empirical data to support their rather interesting and attractive claims. Perhaps previous education has a great effect on how ESL learners process or do not process various rhetorical modes in English. Kaplan has suggested that this is a serious cross-cultural rhetorical problem (Kaplan, 1972). What is needed then is a rigorous empirical methodology for analyzing the very interesting suppositions of the type that Selinker et al. have posited about the nature of scientific rhetoric. This will enable the course planner to provide the learners

with the type of instruction necessary to either process or produce, if necessary, materials that are framed within one or many of the standard rhetorical modes of English. It is in this step of discourse analysis that the planner/researcher must identify the rhetorical/communicative needs of his learner population, just as he determined their grammatical needs in the previous step of text analysis.

The next step in the plan is the adoption of a methodology (or approach) to materials design and the development of a syllabus (curriculum) based on the approach. As seen above in the needs assessment discussion the methodology, i.e., linguistic, functional, etc., is by and large determined by the needs assessment survey of the client population. Even after a thorough needs survey the choice between the competing alternative methodologies is largely based on hunches, faith, on the types of views that the researcher has about language, and on the way in which the four skills of language have to be balanced in order to meet the learners' needs. One beautifully designed syllabus model that is rigorously based on sociolinguistic theory has just recently been designed by John Munby. His *Communicative Syllabus Design* is firmly rooted in and framed with Hymes' sociolinguistic model known as the Ethnography of Communication. This work by Munby is very appealing in that it potentially provides a syllabus model for the universal design of ESP course syllabuses (Munby, 1978). Since Munby's model is new it is precisely at this time that parts of it should be subjected to empirical validation. This is the type of strong curriculum design model that was mentioned above.

The fifth component of Palmer's schema is the evaluation of the methods and materials used in implementing the syllabus. Like Bachman above, Palmer distinguishes between formative and summative evaluation. The formative evaluation is used to gather information about how effective the materials are, and also about how effective the teaching of the materials is. On the basis of such information decisions may be made about the linguistic, psychological, and sociological aspects of the course, and thereby indicate where the syllabus and the teaching are strong and/or where changes are necessary. The summative evaluation compares the particular course under scrutiny with those that have gone before it to determine the overall effectiveness of the program. The results of a summative evaluation would be used to determine, among other things, if a course were to be continued, if the goals of the syllabus were met, or as a guideline for developing similar ESP courses in the future.

Finally, Palmer states that from time to time materials and methods have to be changed or modified based on the effectiveness of the course as determined by ongoing formative evaluation. This I think is a very obvious step in the development of all sound educational coursework, and it need not be treated in any depth here. The standard techniques of developing and modifying materials that are taught in any basic ESL methodology course are probably adaptable to this situation.

In this new era of learner-centered instruction in English as a Second Language teaching, all of the above six steps are essential components of an ESP course planning schema. Two important steps in this schema, however, need further detailed attention at this time while the field of ESP is still young. The first step that needs attention is discourse analysis. Selinker, Trimble et al. have given us some very promising hypothetical models for the rhetorical

structure of scientific English. These models now need to be either supported or rejected as a result of well planned testing procedures that would: (1) isolate the rhetorical devices necessary for the comprehension of scientific prose, and (2) identify which devices will cause problems for the ESL student. The second area that needs further research and development is that of methodology choice and syllabus design. Since ESP programs normally put heavy emphasis on communication skills, newly developed syllabus designs (like Munby's instrument) which stress the development of communication centered curricula should be tested empirically to see if their strong theoretical foundations really do lead to the development of useful and practical communicative syllabuses.

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